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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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SAN DIEGO, CA 92130-2081

EXAMINER

TSANG FOSTER, SUSY N

ART UNIT	PAPER NUMBER
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1745

DATE MAILED: 08/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/034,094

Applicant(s)

NARAYANAN ET AL.

Examiner

Susy N Tsang-Foster

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2004.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
4a) Of the above claim(s) 7-25 is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-6 and 26 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. This Office Action is responsive to the amendment filed on 4/19/2004. Claim 26 is added. Claims 1-26 are pending. Claims 7-25 are withdrawn from further consideration as being directed to non-elected species. Claims 1-6 are finally rejected for the reasons of record. Claim 26 is finally rejected for reasons necessitated by applicant's amendment.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-6 and 26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification does not enable one of ordinary skill in the art to prepare a catalyst material that has an increased surface area by introducing a substance that is insoluble in the catalyst material and subsequently removing the insoluble substance from the catalyst material to increase a surface area of the catalyst material compared to the catalyst material prior to introducing and removing the substance because the specification does not disclose what non-ionic surfactants are used as the substance that is insoluble in the catalyst material, or at what

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high temperature the non-ionic surfactant is removed. The specification does not provide sufficient guidance to one of ordinary skill in the art to achieve the claimed invention without undue experimentation to determine what non-ionic surfactant and high temperature are meant by applicants. It is also unclear how the non-ionic surfactant would be selectively removed at a high temperature without destroying the perfluorovinylether sulfonic acid and polytetrafluoroethylene in the catalyst material.

Furthermore, the specification does not appear to support the limitation of increasing a surface area of the catalyst material by introducing a substance in the catalyst material that is insoluble in the catalyst material since the specification on page 18 states that the surface area of the catalyst is increased, not the surface area of the catalyst material which comprises the catalyst. It is also unclear in paragraph 69 of the specification whether metals such as zinc, aluminum, or tin are the non-ionic surfactants that are volatilized at a high temperature to produce an increased surface area catalyst.

It is also unclear how the zinc, aluminum, or tin is incorporated into the catalyst since the catalyst is normally a noble metal carried on a porous carbon support and the specification does not provide any details on page 18, paragraph 69. Nonetheless, the specification on page 18 does not enable one of ordinary skill in the art to increase the surface area of the catalyst by temporarily introducing a substance that is insoluble in the catalyst and remove by subsequent volatilizing at a high temperature considering the state of the art of increasing the effective surface area of a catalyst for fuel cell applications.

For example, US Patent No. 5,068,161 states:

"It is well known that increasing the effective surface area of the catalyst increases catalyst performance. There are several ways in which this may be achieved. Increasing the amount of

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supported catalyst in the electrode will increase the total effective surface area of active catalyst material. However, this increases the thickness of the fuel cell electrode, increasing internal resistance, thus reducing the overall benefit. Alternately, the weight percent of active metal supported on the carrier may be increased. This allows for an increase of the total amount of active catalyst material in the electrode without increasing the electrode thickness. However, the dispersion of the active metal must be retained at higher loading for this to be effective. It would therefore be very advantageous to make supported Pt alloy catalysts with higher metal loading than is currently practised with useful dispersion (active surface area per weight of metal), preferably at least equivalent to current practice. It has become accepted in the fuel cell catalyst art that a "standard" catalyst formulation comprises approximately 7 to 11% by weight platinum, by itself or as an alloy, on carbon because of the difficulty in achieving useful dispersions of higher metal loading by normally available techniques. The prior art contains many statements concerning the desirability of high surface area, and there are some suggestions that catalysts may be made at weights of up to 20 or 30% by weight total metal on carbon. There are, however, no instances of such high loading Pt alloy catalysts being exemplified in a convincing manner. In particular should be mentioned the techniques described by Stonehart et al in "Modern Aspects of Electrochemistry" Vol. 12, 183 et seq, and Stonehart states that it is possible to reach Pt loadings of 2 to 40 wt % in single component catalysts, using very high surface area carbon blacks (J. Electroanal. Chem., 261 (1989), p375)." (col. 1, line 50 to col. 2, line 19).

As evidenced by US Pat. No. 5,068,161, the effective surface area of the catalyst is conventionally increased by increasing the amount of catalyst that is loaded onto a high surface area carbon support.

It also appears that applicants are confusing the issue between the catalyst itself which is conventionally a noble metal or alloy supported on carbon and a catalyst material comprising catalyst, carbon support and binder. The use of the term "catalyst" and "catalyst material" appears to mean two different things in the present specification and in the claims. **The Examiner is interpreting the term "catalyst material" to mean a catalyst mixture comprising catalyst, carbon support, and binder in light of claim 2 and applicant's specification.** Applicant's specification does not disclose increasing the surface area of the catalyst material comprising perfluorovinyl ether sulfonic acid and polytetrafluoroethylene and instead on page 18 of the specification discloses the statement that the "catalyst" is increased in

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surface area by temporary introduction of a substance insoluble in the catalyst and removable by subsequent leaching may be used to increase the surface area of the catalyst and such a substance can be a surface active substance which will prevent particle agglomeration and can be volatilized at a higher temperature and that non-ionic surfactants may be preferable.

There are no details given as to how the non-ionic surfactant is temporarily introduced into the catalyst and it is unclear what compounds encompass non-ionic surfactants. Applicant also state on page 18 of the specification that the metals such as zinc, aluminum, or tin incorporated in the catalyst during preparation can also serve this function. It is unclear from the previous statement in the specification whether applicant is stating the zinc, aluminum, or tin can be non-ionic surfactants. However, it is unclear what is meant by incorporating zinc, aluminum, or tin in the catalyst during preparation if the zinc, aluminum, or tin is insoluble in the catalyst. If zinc, aluminum, or tin is incorporated during the preparation of the catalyst, the zinc, aluminum, or tin is not temporarily introduced into the catalyst as stated in the specification on page 18 but instead, the zinc, aluminum, or tin is introduced into the catalyst precursor during preparation of the catalyst. It is also unclear how the zinc, aluminum or tin is subsequently removed from the prepared catalyst at a high temperature if it is incorporated into the catalyst without destroying the catalyst.

Hence, it is unclear how an insoluble substance is introduced into the catalyst material and then subsequently removed to increase the surface area of the catalyst material.

With respect to claim 26, it is also unclear how to prepare a catalyst material by introducing at least a metal of zinc, aluminum, or tin as a volatile material and subsequently removing the metal from the catalyst material.

4. Claims 1-6 and 26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

With respect to claims 1-6, the specification does not appear to support the limitation of increasing a surface area of the catalyst material by introducing a substance in the catalyst material that is insoluble in the catalyst material since the specification on page 18 states that the surface area of the catalyst is increased, not the surface area of the catalyst material which comprises the catalyst and other binder components.

Furthermore, the original disclosure does not disclose any of the limitations of claims 2-6 since the catalyst and not the catalyst material was increased in surface area by adding and removing an insoluble substance as stated on page 18 of the specification.

With respect to claim 26, the specification does not appear to support the limitation of preparing a catalyst material to introduce at least a metal of zinc, aluminum, or tin as a volatile material and subsequently removing the metal from the catalyst material to increase a surface area of the catalyst material compared to a surface area of the catalyst material without introducing and removing the metal since the specification on page 18 discloses a method of increasing the surface area of the catalyst, not the catalyst material which comprises other components besides the catalyst itself. Instead, the specification discloses on page 18 that metals such as zinc, aluminum, or tin is incorporated in the catalyst during preparation. However,

details of how this incorporation takes place and subsequent removal of the metals are not given in the specification.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-6 and 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, the limitation “increase a surface area of the catalyst material” is indefinite because it is unclear how the area of the catalyst material is increased since a catalyst material is defined in dependent claim 2 as a mixture comprising several components such as catalyst, perfluorovinylether sulfonic acid and polytetrafluoroethylene.

Similarly, in claim 26, the limitation “preparing a catalyst material to introduce at least a metal of zinc, aluminum, or tin as a volatile material; and subsequently removing the metal from the catalyst material to increase a surface area of the catalyst material compared to a surface area of the catalyst material without introducing and removing the metal” is indefinite *because it is* unclear how the surface area of the catalyst material is increased since a catalyst material is a mixture of several components such as catalyst, perfluorovinylether sulfonic acid and polytetrafluoroethylene (see paragraph 14 of the specification and instant claim 2).

Claims depending from claims rejected under 35 USC 112, second paragraph are also rejected for the same.

Response to Arguments

7. Applicant's arguments filed 4/19/2004 have been fully considered but they are not persuasive.

Applicant appears to have misunderstood that the terms “catalyst material” and “catalyst” are distinct as presently used in the specification and in the instant claims.

The specification discloses a method of increasing the surface area of the catalyst, and does not disclose a method of increasing the surface area of the catalyst material which comprises catalyst, binder, and other components used in a catalyst layer of the fuel cell electrode.

With respect to the 35 USC 112, second paragraph rejections of record, applicant states that claim 1 as written is definite because claim 1 recites two steps to increase the surface area. In response, applicant has not addressed how the surface area of the catalyst material is increased when it contains other components besides the catalyst.

With respect to applicant's assertions that non-ionic surfactants and their properties are well known and well documented in the art, the Examiner is not persuaded by this argument since there are innumerable non-ionic surfactants and one of ordinary skill in the art would not be able to determine from applicant's instant specification which non-ionic surfactants is used to prepare an increased area of the catalyst. Applicant also states that it is well established that a

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patent need not teach, and preferably omits, which is well known in the art. However, applicant has only stated that non-ionic surfactants are well known and not the use of the non-ionic surfactants in increasing the surface area of a catalyst that is well known. Nonetheless, this issue is moot, since applicant claims a method of increasing the catalyst material which is not enabled by the specification, and does not claim a method of increasing the surface area of the catalyst itself.

With respect to applicant's assertions that the process of removing a volatile metal at a higher temperature is used to increase the surface area of the final catalyst material, this process is not disclosed or enabled by the specification since the final catalyst material contains a binder which would be destroyed at a high temperature used to remove the metal. Even though the claims do not recite a process of increasing the surface area of the catalyst, it is unclear how the metal such as zinc, tin, or aluminum would be removed from a catalyst that also contains a metal without volatilizing the catalyst itself which is made of a metal or metals.

It is noted that applicant admits on page 11 of the amendment that in the present application, a mixture material is used to form the catalyst material and is ultimately produced and used in the fuel cell. This admission supports the Examiner's position in the previous and current office action that the terms "catalyst material" and "catalyst" mean two different things. A catalyst material is a mixture that comprises a catalyst. A catalyst is just the catalytic metal itself. Therefore, the instant claims are not supported or enabled by the original disclosure.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster, Ph.D. whose telephone number is (571) 272-1293. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (571) 272-1292.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

st/ *Susy Tsang-Foster*

Susy Tsang-Foster
Primary Examiner
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